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Neuromodulation of lumbosacral spinal networks enables independent stepping after complete paraplegia

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Abstract

© 2018, The Author(s), under exclusive licence to Springer Nature America, Inc. Spinal sensorimotor networks that are functionally disconnected from the brain because of spinal cord injury (SCI) can be facilitated via epidural electrical stimulation (EES) to restore robust, coordinated motor activity in humans with paralysis1–3. Previously, we reported a clinical case of complete sensorimotor paralysis of the lower extremities in which EES restored the ability to stand and the ability to control step-like activity while side-lying or suspended vertically in a body-weight support system (BWS)4. Since then, dynamic task-specific training in the presence of EES, termed multimodal rehabilitation (MMR), was performed for 43 weeks and resulted in bilateral stepping on a treadmill, independent from trainer assistance or BWS. Additionally, MMR enabled independent stepping over ground while using a front-wheeled walker with trainer assistance at the hips to maintain balance. Furthermore, MMR engaged sensorimotor networks to achieve dynamic performance of standing and stepping. To our knowledge, this is the first report of independent stepping enabled by task-specific training in the presence of EES by a human with complete loss of lower extremity sensorimotor function due to SCI.

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